

Technology of GEMs and their applications in detectors.

Introduced in 1968 by Charpak at the European Organization for Nuclear Research (CERN) multiwire proportional chamber revolutionized the particle detection systems in high energy physics.

In time new generations of the invention have been implemented for fast detection and localization charged particles. One of them is Gas Electron Multipliers (GEM). GEM is made of a 50 μm thick polyimide foil covered on both sides with a 5 μm copper layer. A hexagonal pattern of double-conically shaped holes with a diameter of 60–70 μm is etched at a pitch of 140 μm into this sandwich structure. With suitable potentials applied, it acts as powerful preamplifier for electrons released by ionizing radiation in a gas, transferring most of the multiplied electron charge to a pickup electrode or to another amplifying device.

GEM detectors are well suited for photon detection. When the cathode is covered with a photosensitive layer then electrons will be knocked out by photons and will be driven towards the GEM for further amplification. Such a detector combines the wide dynamic range, good spatial resolution, high gain and radiation hardness. They have also proved to be robust, light and offer excellent performances and reliability suited for use in the harsh environments.